WHAT IS CLAIMED IS:

1. A data transmission method for performing continuous data transmission from the transmitting end to the receiving end in units of packets, each packet having additional information relating to its sequence number, priority, and data reproduction time at the receiving end, while successively reproducing data c packets received at the receiving end, said method comprising th steps of:

at the transmitting end,

giving priority information to each packet to be transmitte and

storing, as retransmission data, only data of packets the priorities of which are equal to or higher than a predetermined value, in a retransmission buffer;

at the receiving end,

when a transmission error is detected, detecting the priori information of an error packet; and

when the detected priority is equal to or higher than the predetermined value, outputting a retransmission request for the error packet to the transmitting end by indicating the sequence number of this error packet;

at the transmitting end,

only when the data of the packet having the sequence number which is indicated by the retransmission request from the receiving end is stored in the retransmission buffer,

retransmitting the data of this packet to the receiving end; and

discarding the data stored in the retransmission buffer in order starting from a packet which cannot be in time for data reproduction at the receiving end.

2. The data transmission method of Claim 1 wherein, when the retransmission buffer is filled up to its capacity, an updation process is performed, in which the retransmission data are retained while the data stored in the retransmission buffer are discarded in order, starting from a packet of the earliest reproduction time, on the basis of the reproduction time of each packet stored in the retransmission buffer.

3. The data transmission method of Claim 1 wherein, when the data transmitted from the transmitting end to the receiving end is video data based on MPEG, a packet which contains data corresponding to frames coded by utilizing intra-frame correlation is regarded as a packet having a high priority.

4. The data transmission method of Claim 1 wherein:

at the transmitting end, the additional information relatin to the sequence number and the priority of a predetermined pack(is also embedded in a subsequent packet to be transmitted after the predetermined packet; and

at the receiving end, in the case where a transmission erro

has occurred in the predetermined packet and the additional

information of the predetermined packet has an error, a

retransmission request for the predetermined packet as an error

packet is made on the basis of the additional information of the

predetermined packet which is embedded in the subsequent packet,

when the subsequent packet transmitted after the predetermined

packet is received.

5. The data transmission method of Claim 4 wherein:

at the transmitting end, the process of embedding the

sequence number of a predetermined high priority packet in a

subsequent packet which follows the predetermined high priority

packet is continuously performed until a high priority packet

next to the predetermined high priority packet is transmitted;

and

at the receiving end, the sequence number of another packet

which is embedded in the received packet is extracted, and when

transmission error has occurred in the packet of the extracted

sequence number, a retransmission request for this error packet

is made by indicating the sequence number of this packet.

6. A data transmission apparatus for relaying data which are

successively transmitted from the transmitting end in units of

packets, each packet having additional information relating to

its sequence number, priority, and data reproduction time at the

receiving end, said apparatus comprising:

a receiving unit for receiving the packets transmitted from the transmitting end;

a priority decision unit for deciding the priority of each of the received packets;

a retransmission packet storage unit for storing packets the priorities of which are equal to or higher than a predetermined value, as retransmission packets, on the basis of the priority of each packet decided by the priority decision unit;

a retransmission instruction receiving unit for receiving a retransmission request from a terminal at the receiving end;

a retransmission decision unit for deciding whether retransmission of the packet for which the retransmission request has been made should be performed or not, on the basis of the retransmission request and the storage status of the retransmission packets in the retransmission packet storage unit

a transmission queue management unit for setting the transmission order of the received packets and the packets which have been decided as packets to be retransmitted, on the basis of the additional information; and

a transmission unit for transmitting the data of these packets in the transmission order set by the management unit.

7.   A data receiving apparatus for receiving data which are transmitted from the transmitting end in units of packets, each

packet having additional information relating to its sequence

number, priority, and data reproduction time at the receiving end

and successively reproducing the data for each packet, said

apparatus comprising:

a receiving unit for receiving the packets transmitted from

the transmitting end;

an error packet detection unit for detecting error packets in

which errors have occurred during transmission, and outputting

normal packets which have been transmitted without transmission

errors, on the basis of the data of the received packets;

a packet priority decision unit for receiving the output from

the error packet detection unit, and deciding error packets the

priorities of which are equal to or higher than a predetermined

value; and

a retransmission instruction output unit for outputting a

retransmission request for each of the error packets the

priorities of which are decided as being equal to or higher than

the predetermined value, to the transmitting end, by indicating

the sequence number of this error packet.

8. A data transmission method in which data transmission from

the transmitting end to the receiving end is continuously

performed in units of packets, each packet having additional

information relating to its sequence number, priority, and data

reproduction time at the receiving end, while successively

reproducing data of packets which have arrived at the receiving

end and, at this time, only packets which can be in time for dat

reproduction at the receiving end are retransmitted, said methoc

comprising the steps of:

at the transmitting end,

giving a data reproduction time at the receiving end to

each packet to be transmitted; and

storing, as retransmission data, only data of packets th

priorities of which are equal to or higher than a predetermined

value, in a retransmission buffer;

at the receiving end,

when a transmission error is detected, detecting the

reproduction time for an error packet and the arrival time of tl

error packet, and deciding an arrival time limit in accordance

with the reproduction time; and

when the error packet has arrived before the arrival tin

limit, outputting a retransmission request for the error packet

to the transmitting end by indicating the sequence number of th

error packet;

at the transmitting end,

when the data of the packet having the sequence number

indicated by the retransmission request from the receiving end

stored in the retransmission buffer, retransmitting data of the

packet the transmission time of which does not pass the

reproduction time, to the receiving end, while discarding data

the packet the transmission time of which has passed the

reproduction time; and

discarding the data stored in the retransmission buffer

in order starting from a packet which cannot be in time for data

reproduction at the receiving end.

9. The data transmission method of Claim 8 wherein, when the

retransmission buffer is filled up to its capacity, an updation

process is performed, in which the retransmission data are

retained while the data stored in the retransmission buffer are

discarded in order, starting from a packet of the earliest

reproduction time, on the basis of the reproduction time of each

packet stored in the retransmission buffer.

10. The data transmission method of Claim 8 wherein the arrival

time limit is decided based on at least one of the allowable

packet delay time decided at the receiving end, and the packet

transmission delay time between the transmitting end and the

receiving end.

11. The data transmission method of Claim 8 wherein:

at the transmitting end, additional information relating to

the sequence number and the reproduction time corresponding to a

target packet to be transmitted is embedded in a subsequent

packet to be transmitted after the target packet; and

at the receiving end, when a transmission error of the target packet has occurred and the additional information of the target packet has an error, a retransmission request for the target packet as an error packet is made on the basis of the additional information of the target packet which is embedded in the subsequent packet, when the subsequent packet transmitted after the target packet is received.

12. A data transmission apparatus for relaying data which are successively transmitted from the transmitting end in units of packets, each packet having additional information relating to its sequence number, priority, data reproduction time at the receiving end, said apparatus comprising:

a receiving unit for receiving the packets transmitted from the transmitting end;

a priority decision unit for deciding the priority of each the received packets;

a reproduction time decision unit for deciding packets whic cannot be in time for reproduction at the receiving end, amongst the packets to be transmitted to the receiving end;

a retransmission packet storage unit for storing packets th priorities of which are equal to or higher than a predetermined value, as retransmission packets, on the basis of the priority of each packet decided by the priority decision unit;

a retransmission instruction receiving unit for receiving a

retransmission request from a terminal at the receiving end;

a retransmission decision unit for deciding whether retransmission of the packet for which the retransmission request has been made should be performed or not, on the basis of the retransmission request and the storage status of the retransmission packets in the retransmission packet storage unit;

a transmission queue management unit for setting the transmission order of the received packets and the packets which have been decided as packets to be retransmitted, on the basis of the additional information; and

a transmission unit for transmitting, in the transmission order set by the management unit, the data of packets other than the packets which are decided as packets that cannot be in time for reproduction at the receiving end, by the reproduction time decision unit.

13. A data receiving apparatus for receiving data which are transmitted from the transmitting end in units of packets, each packet having additional information relating to its sequence number, priority, and data reproduction time at the receiving end and successively reproducing the data for each packet, said apparatus comprising:

a receiving unit for receiving the packets transmitted from the transmitting end;

an error packet detection unit for detecting error packets iɪ

which errors have occurred during transmission, and outputting

normal packets which have been transmitted without transmission

errors, on the basis of the data of the received packets;

a reproduction time decision unit for detecting the

reproduction time given to each error packet detected by the

error packet detection unit and the arrival time of the error

packet at the receiving end, and setting the arrival time limit

based on the reproduction time, and deciding whether or not the

error packet has arrived at the receiving end before the arrival

time limit; and

a retransmission instruction output unit for outputting a

retransmission request only for the error packet which has

arrived at the receiving end before the arrival time limit, to

the transmitting end, by indicating the sequence number of the

error packet, on the basis of the result of the decision in the

reproduction time decision unit.

14. A data transmission method for performing continuous data

transmission from the transmitting end to the receiving end in

units of packets, each packet having additional information

relating to its sequence number, priority, and data reproductior

time at the receiving end, while successively reproducing data c

packets arrived at the receiving end, said method comprising the

steps of:

at the transmitting end,

giving a data reproduction time and priority information tc

each packet to be transmitted; and

storing, as retransmission data, only data of packets the

priorities of which are equal to or higher than a predetermined

value, in a retransmission buffer;

at the receiving end,

when a transmission error is detected, detecting the

priority information of an error packet, the reproduction time o

the error packet, and the arrival time of the error packet;

setting the arrival time limit of the error packet on the

basis of the reproduction time; and

when the detected priority is equal to or higher than the

predetermined value and the error packet has arrived before the

arrival time limit, outputting a retransmission request for this

error packet to the transmitting end by indicating the sequence

number of this error packet;

at the transmitting end,

when data of the packet having the sequence number indicatı

by the retransmission request from the receiving end is stored i

the retransmission buffer, retransmitting only data of the packe

the transmission time of which does not pass the reproduction

time, to the receiving end, while discarding data of the packet

the transmission time of which has passed the reproduction time;

and

discarding the data stored in the retransmission buffer in

order starting from a packet which cannot be in time for

reproduction at the receiving end.

15. The data transmission method of Claim 14 wherein:

at the transmitting end, additional information relating to

the sequence number, the priority, and the reproduction time of a

predetermined packet is embedded in a subsequent packet to be

transmitted after the predetermined packet; and

at the receiving end, when a transmission error of the

predetermined packet has occurred and the additional information

of the predetermined packet has an error, a retransmission

request for the predetermined packet as an error packet is made

on the basis of the additional information of the predetermined

packet which is embedded in the subsequent packet, when the

subsequent packet transmitted after the predetermined packet is

received.

16. The data transmission method of Claim 15 wherein:

at the transmitting end, the process of embedding the

sequence number of a predetermined high priority packet in a

subsequent packet which follows the predetermined high priority

packet is continuously performed until a high priority packet

next to the predetermined high priority packet is transmitted;

and

at the receiving end, the sequence number of another packet

which is embedded in the received packet is extracted, and when transmission error has occurred in the packet of the extracted sequence number, a retransmission request for this packet is mad by indicating the sequence number of this packet.

17. The data transmission method of Claim 15 wherein, at the transmitting end, when additional information relating to the sequence number and the reproduction time corresponding to each packet is embedded in a subsequent packet to be transmitted afte the packet, a difference between additional information relating to the sequence number and the reproduction time corresponding t the subsequent packet and the additional information relating to the sequence number and the reproduction time corresponding to the previous packet is embedded as the additional information.

18. A data transmission method for performing data transmission between a distribution server and a terminal through a relay server in units of packets, and successively reproducing data of packets received at the terminal, said method comprising the steps of:

when a transmission error has occurred between the relay server and the terminal, performing retransmission of an error packet by the relay server in response to a retransmission request from the terminal; and

when a transmission error has occurred between the

distribution server and the relay server, performing

retransmission of an error packet by the distribution server in

response to a retransmission request which has been transmitted

from the terminal through the relay server.

19. The data transmission method of Claim 18 wherein, when a

transmission error has occurred between the distribution server

and the relay server, a retransmission request is transmitted

from the relay server to the distribution server, and

retransmission of an error packet to the relay server is

performed by the distribution server.

20. A data transmission apparatus for relaying data which are

successively transmitted from a distribution server, in units of

packets each having additional information relating to its

sequence number, priority, data reproduction time at the

receiving end, said apparatus comprising:

 a receiving unit for receiving the packets transmitted from

the transmitting end;

 a priority decision unit for deciding the priority of each o

the received packets;

 a retransmission packet storage unit for storing packets the

priorities of which are equal to or higher than a predetermined

value, as retransmission packets, on the basis of the priority oï

each packet decided by the priority decision unit;

a retransmission instruction receiving unit for receiving a

retransmission request from a terminal at the receiving end;

a retransmission decision unit for deciding whether

retransmission of the packet for which the retransmission reques

has been made is to be performed or not, on the basis of the

retransmission request and the storage status of the

retransmission packets in the retransmission packet storage unit

a retransmission instruction output unit for outputting the

retransmission request for the error packet requested by the

terminal, to the distribution server, on the basis of the result

of the decision in the retransmission decision unit;

a transmission queue management unit for setting the

transmission order of the received packets and the packets which

have been decided as packets to be retransmitted, on the basis of

the additional information; and

a transmission unit for transmitting the data of these

packets in the transmission order set by the management unit.

21.   A data transmission method for performing continuous data

transmission from the transmitting end to the receiving end in

units of packets, each packet having additional information

relating to its sequence number, priority, and data reproduction

time at the receiving end, while successively reproducing data (

packets received at the receiving end, said method comprising th

steps of:

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at the transmitting end,

when a packet the priority of which is equal to or higher than a predetermined value is transmitted as a high priority packet, storing data of this high priority packet, as retransmission data, in a retransmission buffer;

managing the value of the transmitting end high priority sequence number which corresponds to the number of transmitted high priority packets, and the value of the sequence number of the high priority packet so that these values are correlated with each other; and

transmitting a subsequent packet which follows the high priority packet after embedding the value of the transmitting end high priority sequence number in this subsequent packet;

at the receiving end,

extracting the value of the transmitting end high priority sequence number which is embedded in the received packet;

managing the value of the receiving end high priority sequence number which corresponds to the number of received high priority packets;

when the value of the extracted transmitting end high priority sequence number is not equal to the value of the receiving end high priority sequence number, outputting a retransmission request to the transmitting end, by indicating the value of the transmitting end high priority sequence number which is obtained on the basis of the value of the receiving end high

priority sequence number; and

updating the value of the receiving end high priority sequence number;

at the transmitting end,

only when data of the packet having the sequence number corresponding to the value of the transmitting end high priority sequence number which is indicated by the retransmission request from the receiving end is stored in the retransmission buffer, retransmitting the data of this packet to the receiving end.

22. The data transmission method of Claim 21, wherein:

at the receiving end, when the value of the transmitting e₁ high priority sequence number embedded in the received packet is not equal to the value of the receiving end high priority sequence number, a retransmission request is output to the transmitting end, by listing the values ranging from the value obtained by adding 1 to the receiving end high priority sequence number, to the value of the transmitting end high priority sequence number, as the values of the transmitting end high priority sequence numbers, or by designating the range as the range of the values of the transmitting end high priority sequence numbers; and

at the transmitting end, the sequence numbers corresponding to the values of the plural transmitting end high priority sequence numbers which are indicated by the retransmission

request from the receiving end are retrieved, and only when data of the packets having the sequence numbers obtained by the retrieval are stored in the retransmission buffer, the data of the packets are retransmitted to the receiving end.

23. The data transmission method of Claim 21 wherein:

at the receiving end, the retransmission request is performed continuously be several times, indicating the value of a transmitting end high priority sequence number; and

at the transmitting end, the sequence number corresponding to the value of the transmitting end high priority sequence number which is indicated by the retransmission request from the receiving end is retrieved, and data of the packet having the sequence number obtained by the retrieval is retransmitted to th receiving end and, simultaneously, the correspondence between th value of the sequence number obtained by the retrieval and the value of the transmitting end high priority sequence number indicated by the receiving end is deleted.

24. A data transmission apparatus for relaying data which are successively transmitted from the transmitting end in units of packets, each packet having additional information relating to its sequence number, priority, data reproduction time at the receiving end, said apparatus comprising:

a receiving unit for receiving the packets transmitted from

the transmitting end;

a transmission queue management unit for setting the transmission order of the received packets and packets which are decided as packets to be retransmitted;

a transmission unit for transmitting data of these packets i the transmission order set by the transmission queue management unit;

a priority decision unit for deciding the priority of each c the received packets;

a retransmission packet storage unit for storing packets the priorities of which are equal to or higher than a predetermined value, as retransmission packets, on the basis of the priority o each packet decided by the priority decision unit;

a sequence number management unit for managing the value of the transmitting end high priority sequence number which corresponds to the number of transmitted high priority packets, and the value of the sequence number of the high priority packet so that these values are correlated with each other;

a high priority sequence number insertion unit for embeddin the value of the transmitting end high priority sequence number in a subsequent packet which follows the high priority packet;

a retransmission instruction receiving unit for receiving a retransmission request indicating the high priority sequence number, from a terminal at the transmitting end; and

a retransmission decision unit for deciding whether

retransmission of the packet for which the retransmission reques

has been made is to be performed or not, on the basis of the

retransmission request and the storage status of the

retransmission packets in the retransmission packet storage unit

25. A data receiving apparatus for receiving data which are

transmitted from the transmitting end in units of packets, each

packet having additional information relating to its sequence

number, priority, and data reproduction time at the receiving er

and successively reproducing the data for each packet, said

apparatus comprising:

        a receiving unit for receiving the packets transmitted from

the transmitting end;

        an error packet detection unit for detecting an error packe

in which an error has occurred during transmission, and

outputting a normal packet which has been transmitted without

transmission errors, and the value of the transmitting end high

priority sequence number which corresponds to the number of

transmitted high priority packets and is embedded in the normal

packet;

        a high priority sequence number management unit for managin

the value of the receiving end high priority sequence number

which corresponds to the number of normal high priority packets

which have been received without transmission errors, on the

basis of the output from the error packet detection unit;

a retransmission sequence number decision unit for comparing the value of the transmitting end high priority sequence number from the error packet detection unit with the value of the receiving end high priority sequence number, and when these values are not equal, deciding the value of the transmitting end high priority sequence number for which a retransmission request is to be made, on the basis of the value of the receiving end high priority sequence number; and

a retransmission instruction output unit for outputting a retransmission request to the transmitting end, by indicating th value of the decided transmitting end high priority sequence number.

26. A data structure of a packet for performing data transmission from the transmitting end and the receiving end, wherein:

said packet comprises a header section containing relevant information indicating the attribute of the packet, and a data section containing data to be transmitted; and

said header section comprises at least first and second header information, amongst first header information indicating the sequence number corresponding to the packet, second header information indicating the priority of the packet, and third header information indicating the reproduction time at the receiving end, of the data to be transmitted.

27. The packet data structure of Claim 26 wherein the header section of the packet includes attribute information of a packet which has already been transmitted before the packet.

28. The packet data structure of Claim 27 wherein the header section of the packet includes the first and second information or the first and third information, as attribute information of packet which has already been transmitted before the packet.

29. The packet data structure of Claim 26 wherein the header section of the packet includes the value of the high priority sequence number corresponding to the number of high priority packets which have been transmitted before the packet and having the priorities equal to or higher than a predetermined value.